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the carnivore *Proteles*, the Pteropod bats, and the aye-aye. Also where teeth are lost from the series, as in the canine genus *Dysodus*, and in man. The loss of the hallux and pollex without corresponding gain, in various genera, may be regarded in the same light.

In conclusion, the progressive may be compared with the retrogressive evolution of the Vertebrata, as follows: In the earlier periods and with the lower forms, retrogressive evolution predominated. In the higher classes progressive evolution has predominated. When we consider the history of the first class of vertebrates, the Tunicata, in this respect, and compare it with that of the last class, the Mammalia, the contrast is very great.

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PROGRESS OF NORTH AMERICAN INVERTEBRATE PALÆONTOLOGY FOR 1884.

BY J. B. MARCOU.

THE year that has just passed has been fairly prolific in palæontological work, about fifteen more titles appearing in this review than there were in the last; it is true that a few of them should have been inserted last year, but doubtless some titles have escaped me also this year, and the two errors may be considered to compensate each other; so that we have an increase of about one-third in the number of articles published. There is also a general improvement in the quality of illustrations, though of course there is still plenty of room for improvement, and it is surprising that some palæontologists should persist in publishing a large number of descriptions with no illustrations at all, or with such imperfect illustrations as to render them practically useless; the chief result brought about by such publication of species is an increase of our already voluminous synonymy. The day will doubtless come when descriptions of new species unaccompanied by proper diagnoses and illustrations will no longer be recognized, for it is next to impossible to recognize a form from a meager description unaccompanied by an illustration. The founding of new genera and species on very imperfect specimens is also a very reprehensible practice, for although it may be excellent exercise for the imagination of the author, yet it may introduce errors which it will take a great deal of time and trouble to eradicate, especially when there is no indication that such descriptions

and figures are restored according to the idea that the author had of the way in which they ought to be.

This year we have the first volume of the Transactions of the Royal Society of Canada. The committee on publication cannot be too severely criticised for having printed a large quarto of about 700 pages, containing many interesting papers, without any index, and for using five different systems of pagination, as well as varying the system of headings for each page.

H. M. Ami has notes on *Triarthrus spinosus* in the Trans. Ottawa Field Nat. Club.

Chas. E. Beecher, in Report. P.P.P. 2d Geol. Surv. Penna., has an excellent article on the "Ceratiocaridæ from the Chemung and Waverley groups at Warren, Pennsylvania."

W. B. Billings has "Notes on, and description of some fossils from the Trenton limestone," in the Trans. Ottawa Field Nat. Club.

E. J. Chapman publishes, in the Trans. Roy. Soc. Canada, a "Classification of Crinoids" based on the presence or absence of a canaliculated structure in the calyx and arm plates.

E. W. Claypole has an article "On the occurrence of the genus *Dalmanites* in the Lower Carboniferous rocks of Ohio," in the *Geological Magazine* for July; also a Preliminary note on some fossil Fishes recently discovered in the Silurian rocks of North America, in the AMERICAN NATURALIST for December.

William B. Dwight, in the *Amer. Journ. of Science and Arts* for April, has his fourth article on "Recent explorations in the Wappinger Valley limestone of Dutchess county, New York, No. 4, Descriptions of Calciferous? fossils."

Aug. F. Foerste, in the AMERICAN NATURALIST for January, has a note on "The power of motion in Crinoid stems."

W. M. Fontaine, in the monographs of the U. S. Geol. Survey, has published his "Contributions to the knowledge of the older Mesozoic flora of Virginia." This work is divided into three parts; in the first the author gives a brief description of the geology of the Virginia Mesozoic areas. In the second he describes the flora and compares it with plants from the Triassic, Jurassic and Rhætic of other regions. In the third he republishes Emmons' figures of the Mesozoic flora of N. Carolina, compares it with the Virginia flora, considers both floras as of the same age, and that age as not older than the rhætic.

S. W. Ford, in the *Amer. Journ. Sci. and Arts* for July, has a "Note on the discovery of Primordial fossils in the town of Stuyvesant, Columbia county, N. York."

James Hall has published another abstract of a paper to be issued in the 35th museum report of the State of N. Y., containing descriptions of the species of fossil reticulate sponges, constituting the family Dictyospongiidæ; the plates were published before with the title, "Notes on the family Dictyospongiæ." An abstract of this article appeared in the *Geological Magazine* for December. The same number of the *Geological Magazine* contains an abstract of a paper "On the Lamellibranchiate fauna of the Upper Helderberg, Hamilton, Portage, Chemung and Catskill groups (equivalent to the Lower, Middle and Upper Devonian of Europe); with especial reference to the arrangement of the Monomyaria and the development and distribution of the species of the genus *Leptodesma*."

G. Hambach, in the *Trans. Acad. Sci. St. Louis*, Vol. iv, No. 3, has "Notes about the structure and classification of the Pentremites. In the same volume he has also an article describing some "New Palæozoic Echinodermata."

Angelo Heilprin has published "North American Tertiary Ostreidæ" as an appendix to Dr. White's review of the fossil Ostreidæ. He describes a Carboniferous Ammonite from Texas in the *Proc. Acad. Nat. Sci. Philadelphia*. He has also published a collection of his works on the Tertiary, under the title "Contributions to the Tertiary geology and palæontology of the United States."

Alpheus Hyatt, in *Science*, Vol. III, has an article on the "Evolution of the Cephalopoda." In the *AMER. NATURALIST* for September he has a note on the "Protoconch of Cephalopoda." In the *Proc. Boston Soc. Nat. Hist.* he places a paper, preliminary to a monograph which will appear in the memoirs of the Museum of Comp. Zoology, on the "Genera of fossil Cephalopods." In the *Proc. of the Amer. Assoc. for the Adv. of Sci.*, August, 1883, he has a paper on the "Fossil Cephalopoda in the Museum of Comparative Zoology," containing a discussion of the relations of this group.

J. F. James, in *Science*, Vol. III, criticises two of the determinations made by Leo Lesquereux in his Tertiary flora U. S. Geol. and Geog. Surv. Terr., F. V. Hayden. [This work although printed has not yet been distributed.] He also has an article on

"The Fucoids of the Cincinnati group," in the Journ. Cincinnati Soc. Nat. Hist., Vol. VII.

U. P. James, in the Journ. Cincinnati Soc. Nat. Hist., Vol. VII, publishes three articles; in the April number he describes three fossils from the Cincinnati group. In the October number he describes four new species of fossils from the Cincinnati group; and in the same number he has also an article "On Conodonts and fossil annelid jaws."

T. R. Jones and J. W. Kirby, in the *Geological Magazine* for August, have descriptions and notes "On some Carboniferous Entomostraca from Nova Scotia."

Leo Lesquereux, in the 2d Geol. Surv. Pennsylvania, Rep. Progress P., Vol. III, finishes his description of the coal flora of the Carboniferous formation in Pennsylvania and throughout the United States. This contains also additions and corrections to the first two parts previously published.

In the 13th annual report of the Indiana Department of Geology and Natural History, the same author publishes "Principles of Palæozoic Botany," an excellent elementary treatise. The Indiana Geol. Surv. has done excellent work in the way of popular instruction, and it is to be hoped that its labors will not be permanently discontinued. In the AMERICAN NATURALIST for September the author has an article on "The Carboniferous flora of Rhode Island."

J. B. Marcou, in the AMERICAN NATURALIST for April, published a review of the progress of North American invertebrate palæontology for 1883.

G. F. Matthew has two short abstracts of articles in the *Geological Magazine* for October: "The primitive Conocorypcean," and "The geological age of the Acadian fauna." In the Trans. Royal Soc. of Canada, Vol. I, the same author has "Illustrations of the fauna of the St. John group, No. 1, The Paradoxides," and a supplementary section describing the parts of the previously described species.

John Mickleborough, in the *Geological Magazine* for February, republishes his article on the "Locomotory appendages of Trilobites" (see last year's review).

S. A. Miller published a "Description of a beautiful star-fish and other fossils" from the Cincinnati group in the April number of the Journ. Cincinnati Soc. Nat. Hist.

Otto Myer, in the Proc. Acad. Nat. Sci., Philadelphia, published "Notes on Tertiary shells." In these notes he proposes the n. g. *Tibiella*, but gives no synopsis of generic characters.

M. Neumayr, in the Neu. Jahrb. für Min., Geol. und Pal., Stuttgart, notes the parallel position occupied by the Laramie group in N. W. America, and the Intertrappean beds of the Deccan in Hindostan.

E. N. S. Ringueberg, in the Proc. Acad. Nat. Sci. Philadelphia, has descriptions of "New fossils from the four groups of the Niagara period of Western New York."

S. H. Scudder, in the *Amer. Journ. Sci. and Arts* for September, has an article on Triassic insects from the Rocky mountains. Mr. Scudder identifies these beds as belonging to the Triassic period, according to their insect fauna. Mr. Lesquereux considers that their flora shows them to be of Permian age. In the Mem. Boston Soc. Nat. Hist., Vol. III, he has an article on "Two new and diverse types of Carboniferous myriapods," and in the same publication he has also "The species of *Mylacris*, a Carboniferous genus of cockroaches." In the Proc. Amer. Acad. Arts and Sci. Boston, the same author has two articles, one "A contribution to our knowledge of Palæozoic Arachnida;" the other on "Dictyoneura and the allied insects of the Carboniferous epoch." This last is a brief paper published in advance of a fuller memoir with detailed descriptions and full illustrations.

J. W. Spencer, in the Bull. Museum of the University of the State of Missouri, publishes an article on "Niagara fossils," which will be reproduced also in the Proc. St. Louis Acad. Sci., Vol. iv, No. 4. The illustrations are so bad and the species in some instances, *e. g.*, *Cyrtoceras reversum*, founded apparently on such poor specimens that it will be very difficult if not impossible for future workers to recognize Mr. Spencer's types.

Frank Springer, in the *Amer. Journ. Sci. and Arts* for February, has an article "On the occurrence of the Lower Burlington limestone in New Mexico.

E. O. Ulrich, in the Journ. Cincinnati Soc. Nat. Hist., December, 1883, continues his descriptions of N. American Palæozoic Bryozoa.

C. D. Walcott has published his "Palæontology of the Eureka district," being Vol. VIII of the monographs of the U. S. Geological Survey. The discussion of the development of *Olenellus*

howelli is very interesting. The discovery in the Devonian of the interior of a dorsal valve of *Lingula whitei* proves the great similarity of structure between the Lingulæ of the Silurian, Devonian and recent time. A commingling of Upper Devonian and Lower Carboniferous fossils occurs; there occurs also a gradual transition from the beds containing *Olenellus howelli* through beds containing a fauna similar to the Potsdam of New York, to beds containing a fauna comparable to that of the chazy and calciferous groups. The transition is very gradual, and such as would occur where there had been no marked physical disturbance. In the Bull. U. S. Geological Survey the same author has "Preliminary studies on the Cambrian faunas of N. America." These are in three parts, the first is "A review of the fauna of the St. John formation, contained in the Hartt collection." This work is not meant to encroach on that of Mr. Matthew. Mr. Walcott does not accept the genus *Conocephalites*, and refers its different species to *Ptychoparia* and one of *Conocoryphe*. The second part is on the "Fauna of the Braintree Argillites." The third part contains the description of a new genus and species of *Phyllopora* from the Middle Cambrian slates of Parker's farm, Georgia, Vermont. In *Science*, Vol. III, the same author has an article on the "Appendages of the Trilobite;" he notes the verification of the hypothesis that the legs were jointed beneath the pygidium as the only addition to our knowledge furnished by Mr. Mickleborough's specimen.

Lester F. Ward, in the *Amer. Jour. of Sci. and Arts*, has an article "On Mesozoic Dicotyledons."

C. A. White, in the Rep. of the Secretary of the Interior for 1883, Vol. III, gives "A review of the fossil *Ostreidæ*, North America, and a comparison of the fossil with the living forms. With appendices by Professor Angelo Heilprin and Mr. John A. Ryder." This work is on the same plan as that followed in the review of the non-marine fossil *Mollusca* published the year previous. In the Bull. of the U. S. Geological Survey, No. 4, the author has three articles, the first, "On a small collection of Mesozoic fossils collected in Alaska, by Mr. W. H. Dall, of the U. S. Coast Survey." The author considers these forms to belong to beds occupying a transitional position between Cretaceous and Jurassic, as previously suggested by Professor J. Marcou. The second is a "Description of certain aberrant forms of the Chami-

dæ from the Cretaceous rocks of Texas." And the third is "On the nautiloid genus *Enclimatoceras* Hyatt, and a description of the type species." In Vol. VI of the Proc. of the U. S. National Museum he has an article "On the *Macrocheilus* of Phillips, *Plectostylus* of Conrad, and *Soleniscus* of Meek and Worthen. In *Science*, Vol. III, he has a note on the "Enemies and parasites of the oyster, past and present." In the 13th annual report of the Indiana Department of Geol. and Nat. Hist., the same author has "The fossils of the Indiana rocks, No. 3." In this work he gives excellent illustrated descriptions of the characteristic invertebrate animal remains of the Carboniferous period.

J. F. Whiteaves, in the Geol. and Nat. Hist. Surv. of Canada, has Part III of his Mesozoic fossils, "On the fossils of the coal-bearing deposits of the Queen Charlotte islands collected by Dr. G. M. Dawson in 1878. The author is driven by his conclusions to assert that the Jurassic of the Black hills and Rocky mountains is Cretaceous. This assertion is far from being justified by the facts which the author adduces for its support. He has also Part I of Vol. III of "Paleozoic fossils." In the Trans. Royal Soc. Canada, he has an article on the "Lower Cretaceous rocks of British Columbia." In this article he holds that the presence of an abundance of *Ancellæ* is a sure proof of the Neocomian age of the rocks in which they occur. In the same publication he has also an article "On some supposed Annelid tracts from the Gaspé sandstones."

R. P. Whitfield, in the Bull. Amer. Museum Nat. Hist. Vol. I, No. 5, has a "Notice of some new species of primordial fossils in the collections of the museum, and corrections of previously described species." He thinks that the difference in faunas between the different Cambrian areas is more the result of the conditions upon which life depended than a difference in time.

H. S. Williams, in the Bull. U. S. Geol. Surv., Vol. No. 3, has an article "On the fossil faunas of the Upper Devonian along the meridian 76° 30' from Tompkins county, New York, to Bradford county, Pennsylvania." The paper is the first of a series. In *Science*, Vol. III, he has an article on "The Spirifers of the Upper Devonian."

H. Woodward, in the *Geological Magazine* for February and for April, has two articles, one is "On the structure of Trilobites." This is a reproduction of the author's views on the ap-

pendages of trilobites, and in particular of *Asaphus platycephalus* Stokes, as published by him in 1871. The other bears the title, "Notes on the appendages of Trilobites. Note to accompany three woodcuts of *Asaphus megistos*, a trilobite discovered by Mr. James Pugh, near Oxford, Ohio, in the upper portion of the Hudson River group." The figures are a reproduction of Mr. Mickleborough's.

A. H. Worthen, in Bull. No. 2 of the Illinois State Museum Nat. Hist., publishes descriptions of two new species of Crustacea, fifty-one species of Mollusca and three species of Crinoids from the Carboniferous formation of Illinois and adjacent States. No illustrations whatever accompany these numerous descriptions.

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THE CLAM-WORM.

BY SAMUEL LOCKWOOD, PH.D.

WALKING at low tide on the wet flats of the New Jersey shore, the stranger is surprised by little spurts of water suddenly springing from the sand. These jets reveal the hiding places of the soft clam, or "nanny nose," a corruption of the Indian name "maninose." This discharge of water at the approach of footsteps, thus betraying its retreat, is an act which the mollusk cannot help. The home of the bivalve is often many inches deep in the sand, but the extensile siphon must reach the surface. Alarmed at the tremor of the sand caused by the approaching steps, this organ is so rapidly withdrawn, even down into the valves at the bottom of the perpendicular burrow, that the sudden collapse expels the water with which the siphon and other cavities of the body are filled. Without such result the rapid retreat of the siphon from harm's way would be impossible. After one of these squirts I have dug fully fourteen inches deep, and found the clam with all its parts snugly tucked within its two valves.

The water ejected as described is simply the fluid which was taken in before the tide went out. If the observer will be quiet and keep motionless for a few minutes the clam may soon regain its confidence, and the tip of the siphon, with its two pretty orifices—the inlet and the outlet, again appear at the little hole in the sand. Now let one's foot be moved, and again the siphon is